8W-97 POWER DISTRIBUTION

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POWER DISTRIBUTION

DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. The power distribution system for this vehicle consists of the following components:

- Integrated Power Module (IPM)
- Front Control Module (FCM)
- Power Distribution Center (PDC)
- Power Outlets
- Cigar Lighter Outlets
- Relays

Refer to Wiring Diagrams for complete circuit schematics.

The power distribution system also incorporates various types of circuit control and protection features, including:

- Automatic resetting circuit breakers
- Blade-type fuses
- Cartridge fuses
- Relays

Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features and use of all of the power distribution system components.

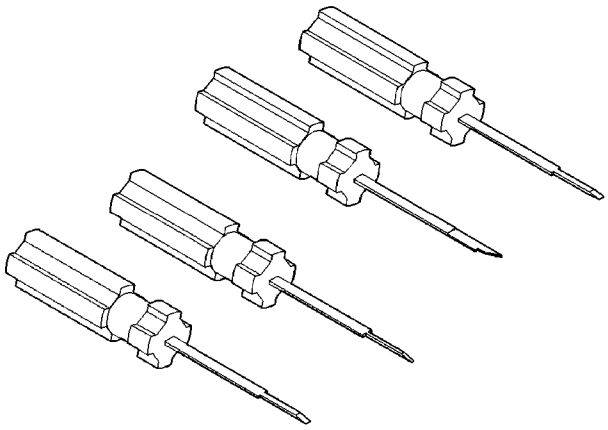
OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the sourcing of additional electrical circuits that may be required to provide the electrical current needed to operate many accessories that the vehicle owner may choose to have installed in the aftermarket.

POWER DISTRIBUTION (Continued)

SPECIAL TOOLS

POWER DISTRIBUTION SYSTEMS



Terminal Pick Kit 6680

CIGAR LIGHTER OUTLET

DESCRIPTION

On models equipped a cigar lighter outlet is installed to the left of the center stack area in the lower instrument panel. The cigar lighter outlet is secured by a snap fit within the bezel.

The cigar lighter outlet, plastic cap and the knob and heating element unit are available for service replacement. These components cannot be repaired and, if faulty or damaged, they must be replaced.

OPERATION

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or outlet shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse in the junction block when the ignition switch is in the Accessory or Run positions.

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the outlet shell, the heating element resistor coil is grounded through its housing to the outlet shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the outlet shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the outlet shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the outlet shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Check the fused B(+) fuse in the integrated power module. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Run position. Check for battery voltage at the fused B(+) fuse in the integrated power module. If OK, go to Step 3. If not OK, repair the open or short as required.

(3) Remove the cigar lighter knob and element from the cigar lighter outlet shell. Check for continuity between the inside circumference of the cigar lighter outlet shell and a good ground. there should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the Run position. Check for battery voltage at the insulated contact located at the back of the cigar lighter outlet shell. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 5.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the Accessory or Run positions. Check for battery voltage at the fused B(+) circuit cavity of the cigar lighter wire harness connector. If OK, replace the faulty cigar lighter outlet. If not OK, repair the open fused B(+) circuit to the integrated power module fuse as required.

INTEGRATED POWER MODULE

DESCRIPTION

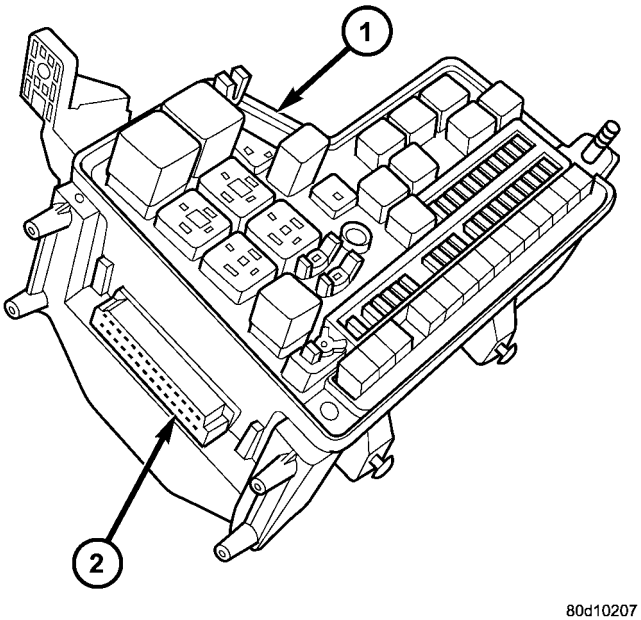


Fig. 1 DR INTEGRATED POWER MODULE

1 - POWER DISTRIBUTION CENTER HOUSING
2 - FRONT CONTROL MODULE ELECTRICAL CONNECTOR

The Integrated Power Module (IPM) (Fig. 1) is a combination of the Power Distribution Center (PDC) and the Front Control Module (FCM). The IPM is located in the engine compartment, next to the battery on this model. The power distribution center mates directly with the Front Control Module (FCM) to form the Integrated Power Module Fuse and Relay Center. The power distribution center (PDC) is a printed circuit board based module that contains fuses and relays, while the front control module contains the electronics controlling the integrated power module and other functions. This integrated power module connects directly to the battery positive via a stud located on top of the unit. The ground connection is via electrical connectors. The integrated power module provides the primary means of voltage distribution and protection for the entire vehicle.

The molded plastic integrated power module housing includes a base and cover. The integrated power module cover is easily opened or removed for service access by unscrewing the cover retaining nut and has a fuse and relay layout map integral to the inside surface of the cover. This integrated power module housing base and cover are secured in place via bolts to the left front fender support assembly.

Replaceable components of the integrated power module assembly are broken down into the following components: the Power Distribution Center (PDC), the integrated power module cover, the Front Control Module (FCM) and the Integrated Power Module Assembly which includes the power distribution center, the cover and FCM. **Refer to the Front Control Module in the Electronic Control Module section** of this service manual for information on the front control module.

OPERATION

All of the current from the battery and the generator output enters the integrated power module via a stud on the top of the module. The integrated power module cover is removed to access the fuses or relays. Internal connections of all of the power distribution center circuits is accomplished by a combination of bus bars and a printed circuit board. Refer to the Wiring section of the service manual for complete integrated power module circuit schematics.

REMOVAL

(1) Disconnect the negative and positive battery cables.

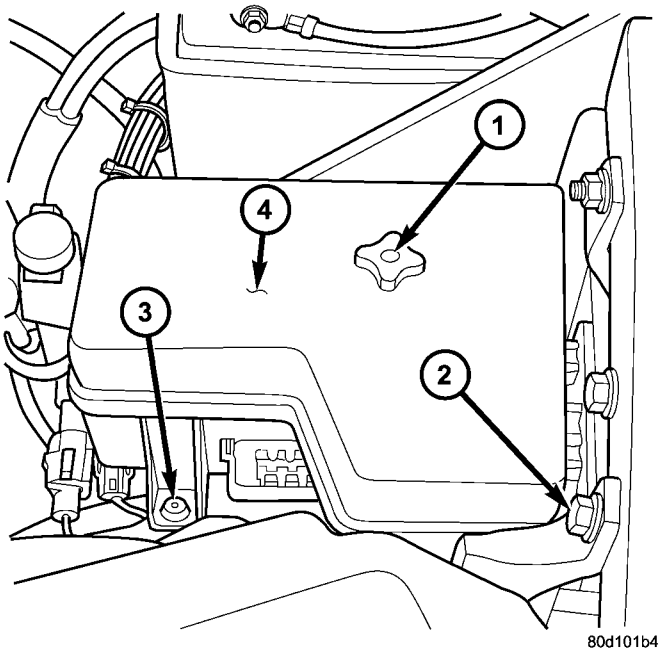


Fig. 2 DR INTEGRATED POWER MODULE

1 - COVER RETAINING BOLT
2 - INTEGRATED POWER MODULE RETAINING BOLT
3 - RETAINING SCREW
4 - INTEGRATED POWER MODULE COVER

(2) Unsnap cover and remove the B+ terminal nut from the integrated power module B+ terminal. Remove the B+ cable from the integrated power module.

(3) Disconnect the gray connector from the integrated power module.

INTEGRATED POWER MODULE (Continued)

(4) Remove the integrated power module retaining bolt and screw (Fig. 2).

(5) Grasp the integrated power module with two hands and slide the assembly in the direction shown (Fig. 3) to free the module from its mounting bracket. Position the assembly upside down to access the electrical connectors located on the bottom of the unit.

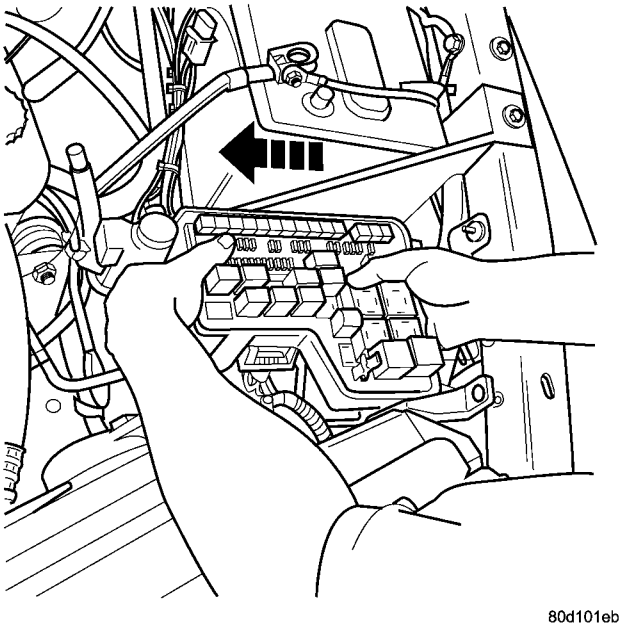


Fig. 3 REMOVING INTEGRATED POWER MODULE

(6) Disconnect the electrical connectors by depressing the locking tab and rotating the connector arm outboard, until the connector is free from the module assembly. Be certain to pull the connectors straight off.

(7) Position the integrated power module on a bench and remove the four front control module retaining screws.

(8) Disconnect the front control module by pulling it straight off the integrated power module.

LLATION

INSTALLATION

(1) Connect the front control module by pushing it straight on the integrated power module electrical receptacle.

(2) Install the four front control module retaining screws. Torque to 30 in. lbs. +/-5.

NOTE: Integrated power module electrical connectors are color coded to ease location reference (Fig. 4).

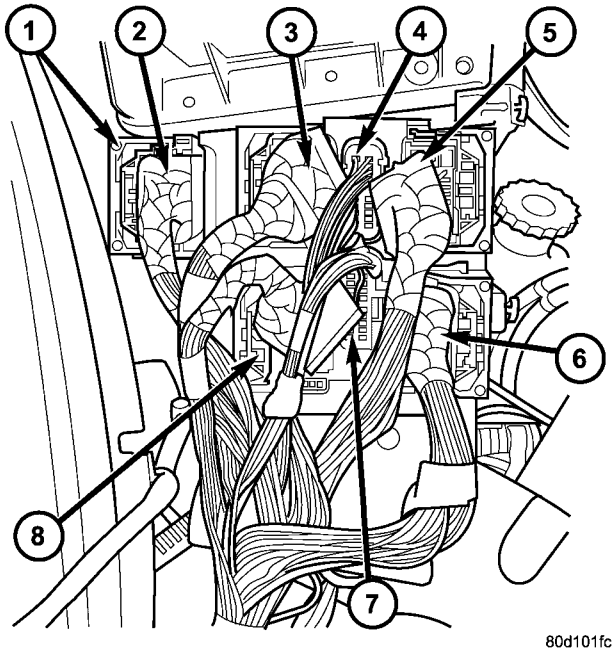


Fig. 4 INTEGRATED POWER MODULE ELECTRICAL CONNECTIONS

1 - RETAINING LATCH
2 - GRAY CONNECTOR
3 - GREEN CONNECTOR
4 - GREEN CONNECTOR
5 - BLUE CONNECTOR
6 - WHITE CONNECTOR
7 - BLACK CONNECTOR
8 - BLACK CONNECTOR

INTEGRATED POWER MODULE (Continued)

(3) Connect the electrical connectors by pushing straight on and rotating the connector arm inboard, until the connector is firmly locked in place on the module assembly.

(4) Grasp the integrated power module with two hands and install the assembly on the battery tray (Fig. 5).

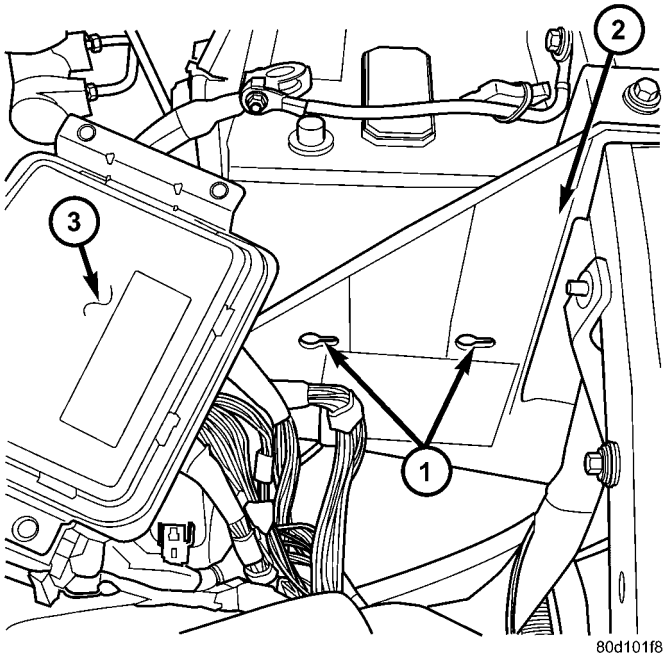


Fig. 5 INTEGRATED POWER MODULE MOUNTING TABS

1 - INTEGRATED POWER MODULE MOUNTING HOLES
2 - BATTERY TRAY ASSEMBLY
3 - FRONT CONTROL MODULE

(5) Install the integrated power module retaining bolt and screw.

(6) Connect the gray connector on the integrated power module housing.

(7) Install the B+ terminal cable and nut on the integrated power module B+ terminal. Snap the cover in place.

(8) Connect the negative and positive battery cables.

FRONT CONTROL MODULE

DESCRIPTION

The Front Control Module (FCM) is a micro controller based module located in the left front corner of the engine compartment. On this model the integrated power module must be positioned aside in order to access the front control module. The front control module mates to the power distribution center to form the Integrated Power Module (IPM). The integrated power module connects directly to the battery and provides the primary means of circuit protection and power distribution for all vehicle electrical systems. The front control module controls power to some of these vehicle systems electrical and electromechanical loads based on inputs received from hard wired switch inputs and data received on the PCI bus circuit (J1850).

For information on the **Integrated Power Module Refer to the Power Distribution Section** of the service manual.

OPERATION

As messages are sent over the PCI bus circuit, the front control module reads these messages and controls power to some of the vehicles electrical systems by completing the circuit to ground (low side driver) or completing the circuit to 12 volt power (high side driver). The following functions are **Controlled** by the Front Control Module:

- Headlamp Power with Voltage Regulation
- Windshield Wiper “ON/OFF” Relay Actuation
- Windshield Wiper “HI/LO” Relay Actuation
- Windshield Washer Pump Motor
- Fog Lamp Relay Actuation
- Park Lamp Relay Actuation
- Horn Relay Actuation

The following inputs are **Received/Monitored** by the Front Control Module:

- B+ Connection Detection
- Power Ground
- Ambient Temperature Sensing
- Ignition Switch Run
- Washer Fluid Level Switch
- Windshield Wiper Park Switch
- PCI Bus Circuit

DIAGNOSIS AND TESTING - FRONT CONTROL MODULE

The front control module is a printed circuit board based module with a on-board micro-processor. The front control module interfaces with other electronic modules in the vehicle via the Programmable Communications Interface (PCI) data bus (J1850). In order to obtain conclusive testing the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the front control module must be checked. All PCI (J1850) communication faults must be resolved prior to further diagnosing any front control module related issues.

The front control module was designed to be diagnosed with an appropriate diagnostic scan tool, such as the DRB III®. The most reliable, efficient, and accurate means to diagnose the front control module

FRONT CONTROL MODULE (Continued)

requires the use of a DRB III® scan tool and the proper Body Diagnostic Procedures manual.

Before any testing of the front control module is attempted, the battery should be fully charged and all wire harness and ground connections inspected around the affected areas on the vehicle.

REMOVAL

(1) Disconnect the positive and negative battery cables from the battery.

(2) Partially remove the integrated power module from the engine compartment (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - REMOVAL).

(3) Remove the front control module retaining screws.

(4) Using both hands, pull the front control module **straight** from the integrated power module assembly to disconnect the 49-way electrical connector and remove the front control module from the vehicle.

INSTALLATION

(1) Install the front control module on the integrated power module assembly by pushing the 49-way electrical connector straight in.

(2) Install the front control module retaining screws. Torque the screws to 7 in. lbs.

(3) Install the integrated power module (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - INSTALLATION).

(4) Connect the positive and negative battery cables.

IOD FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is disconnected within the Integrated Power Module when the vehicle is shipped from the factory. Dealer personnel are to reconnect the IOD fuse in the Integrated Power Module as part of the preparation procedures performed just prior to new vehicle delivery.

A laser printed fuse layout map is integral to the Integrated Power Module cover to ensure proper fuse identification. The IOD fuse is a 20 ampere mini blade-type fuse, located in fuse cavity # 51 (Fig. 6). The fuse is secured within a black molded plastic fuse holder and puller unit that serves both as a tool for disconnecting and reconnecting the fuse in its Integrated Power Module cavity, and as a fuse holder that conveniently stores the fuse in the same Integrated Power Module cavity after it has been disconnected.

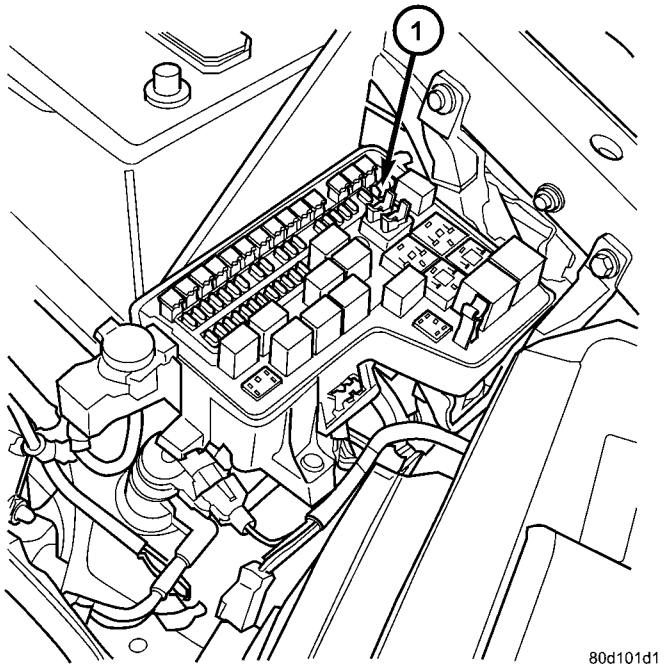


Fig. 6 IOD FUSE LOCATION

1 - IOD FUSE

CIRCUITS INCLUDED WITH IOD FUSE

- Cluster (CCN)
- Diagnostic Connector
- Map Lamps
- Glove Box Lamp
- Courtesy Lamps
- Radio
- Underhood Lamp

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position. The only reason the IOD fuse is disconnected is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is disconnected from Integrated Power Module fuse cavity # 51 when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse

IOD FUSE (Continued)

becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that disconnecting the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged.

REMOVAL

The Ignition-Off Draw (IOD) fuse is disconnected from Integrated Power Module fuse cavity # 51 when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation.

(1) Turn the ignition switch to the Off position.

(2) Remove the Integrated Power Module cover.

(3) Grasp the outer tabs of the IOD fuse holder unit in fuse cavity # 51 between the thumb and forefinger and pull the unit firmly upward.

(4) Install the Integrated Power Module cover.

INSTALLATION

(1) Turn the ignition switch to the Off position.

(2) Remove the Integrated Power Module cover.

(3) To install the IOD fuse, use a thumb to press the IOD fuse holder unit in fuse cavity # 51 firmly into the Integrated Power Module.

(4) Install the Integrated Power Module cover.

POWER OUTLET

DESCRIPTION

Two power outlets are utilized on this model. One in the instrument panel center lower bezel and the other in the center console. The power outlet bases are secured by a snap fit within the instrument panel or trim panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the integrated power module at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING - POWER OUTLET

For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Check the fused B(+) fuse in the integrated power module. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the integrated power module. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.

(3) Remove the plastic protective cap from the power outlet receptacle. Check for continuity between the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the power outlet receptacle from the instrument panel. Disconnect the wire harness connector from the power outlet receptacle. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the integrated power module fuse as required.

POWER OUTLET (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the cigar lighter knob and element out of the cigar lighter receptacle base, or unsnap the protective cap from the power outlet receptacle base.

(3) Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the panel (Fig. 7).

(4) Insert a pair of external snap ring pliers into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(5) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(6) Pull the receptacle base away from the instrument panel far enough to access the instrument panel wire harness connector.

(7) Disconnect the instrument panel wire harness connector from the cigar lighter or power outlet receptacle base connector receptacle.

(8) Remove the cigar lighter or power outlet mount from the instrument panel.

INSTALLATION

(1) Reconnect the instrument panel wire harness connector to the cigar lighter or power outlet receptacle base connector receptacle.

(2) Install the cigar lighter or power outlet mount into the instrument panel.

(3) Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

(4) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

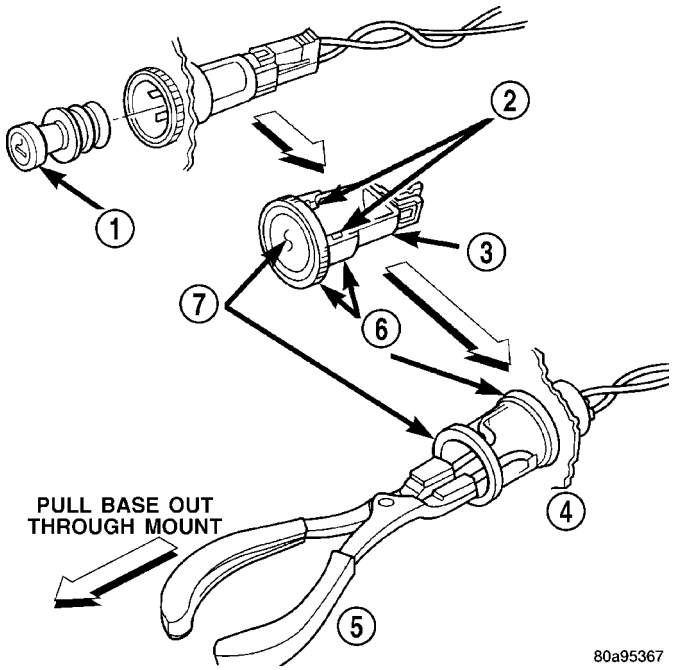


Fig. 7 Cigar Lighter and Power Outlet Remove/ Install

1 - KNOB AND ELEMENT
2 - RETAINING BOSSES-ENGAGE PLIERS HERE
3 - BASE
4 - PARTIALLY REMOVED
5 - EXTERNAL SNAP-RING PLIERS
6 - MOUNT
7 - BASE

(5) Install the cigar lighter knob and element into the cigar lighter receptacle base, or the protective cap into the power outlet receptacle base.

(6) Reconnect the battery negative cable.